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ABSTRACT

A system of classifying research universities is proposed based on quantitative criteria. Data from several studies were used to develop a list of 57 leading U.S. research universities. The Carnegie Commission's 1973 and 1976 classification of "Research Universities I" and the Academy for Educational Development's listing are presented, along with research university lists developed by the Association of Research Libraries. Additional lists include: the leading universities in terms of total financial support for research for 1983; and the leading research universities based on total research and development expenditures, Ph.D. production, faculty size, and size of research libraries. These lists, which rank universities on the basis of standards, were subjected to a four-step elimination process, which begins with the 100 leading universities that received the largest support for scientific research in 1983. From this list, schools were eliminated that did not produce at least 100 Ph.D.s in 1983, and schools that employed fewer than 1,000 full-time scientists and engineers as faculty members. Further selection was based on having an outstanding research library.
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A PROPOSED SYSTEM FOR CLASSIFYING RESEARCH UNIVERSITIES

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A Proposed System for Classifying Research Universities

There have been numerous attempts to rank or to classify universities in the past several years. Most of these might be called "reputational" ranking attempts, while a few have used quantifiable criteria upon which to base their conclusions.

Some attempted a combination of both, but these have, for the most part, been rankings of the reputation/productivity of departments or areas within the university, rather than of the university as a whole.

My intent here is to suggest a system of classification of research universities (with emphasis on science) based on quantitative criteria selected because of the generally accepted idea that research universities should meet certain common standards. Each has an outstanding library or libraries, has a "critical mass" of faculty members, is of sufficient size and scope to award a considerable number of doctorates in the sciences and engineering, and is able to attract a significant amount of research support from all sources--state, federal, and private.

Previous studies have treated these standards separately to rank universities. I shall use the rankings from those studies to provide a broader foundation for classification.

First, a look at why a new system of classification is important. It is perhaps axiomatic that it takes an institution at least a generation to build a reputation--or to change one. We all know of departments within universities that were considered great 20 years ago which now have lost many of their most distinguished faculty members, their output of publications in prestigious journals, and their attraction for graduate students and postdoctoral fellows, and yet they are still frequently listed among the "top 10" in surveys of practitioners in the field. Some of these respondents no doubt still tend to think of those departments in terms of their "glory days." So it is with universities.

The reverse is equally true. Some institutions which did not even exist 30 years ago may now be classified as research universities, and others, which 30 years ago may have been known as strong undergraduate colleges, have now reached the status of "great" research universities.

One frequently sees lists of the "top 10" departments (or schools or colleges of this and that) based entirely upon a mail survey of faculty members, department heads, and/or deans in institutions across the nation. Many of these simply ask the

recipient of the form or letter to "rank," in order, the "top 10" programs nationally, without definition, without criteria, and without further guidance. Pride, loyalty--call it what you may--will prompt the dean of the School of Law at Universal University to list his alma mater first (or second), then Harvard, Yale or Stanford, et cetera.

If the survey researcher has included in his form a list of quantitative criteria for the consideration of his respondents, his published list of the "top 10" law schools might have been quite different.

At least two studies in the past 10 years have attempted not to rank, but to classify universities on the basis of such criteria. In 1973, The Carnegie Commission on Higher Education published A Classification of Institutions of Higher Education as one of its technical reports.(1) The report "sought to identify categories of colleges and universities that would be relatively homogenous with respect to the functions of the institutions as well as with respect to characteristics of students and faculty members."

The report identified "Doctoral-Granting Institutions," which were further classified as "Research Universities I," and "Doctoral-Granting Universities II."

Its other classifications included "Comprehensive Universities and Colleges, I and II," and "Professional Schools and Other Specified Institutions," with several classifications, by fields of study, within that category.

The category, "Research Universities I," in the 1973 Carnegie Commission report included "the 50 leading universities in terms of federal financial support of academic science in at least two of three academic years, 1968-69, 1969-70, and 1970-71, provided they awarded at least 50 Ph.D.'s (plus M.D.'s if a medical school was on the same campus) in 1969-70." The report states that "Rockefeller University was included because of the high quality of its research and doctoral training, although it did not meet criteria."

Thus, the Carnegie Commission chose to base its list of "50 Research Universities I," on a combination of two quantitative criteria--a minimum of "50 Ph.D.'s" (or "M.D.'s") awarded in a given year (1969-70) and outside support of research from federal sources in at least two of the three academic years between 1968 and 1971. (Actually there are 52 "Research Universities I" listed in the report, 30 public institutions and 22 private).

The Carnegie Commission report was updated in 1976, using the same quantifiable criteria--doctorates awarded and federal financial support--but for the years 1972-75 rather than 1968-72.(2)

In the 1976 report three institutions (two public and one private) were added, and four (three public and one private) were dropped. Thus, as shown in Table I, the 1976 report lists 51 "Research Universities I."

Note the shifting of ranks; two public universities which attained "Research University I" ranking in 1976 were listed in 1973 as "Research Universities II," while the private institution that "moved up" was not listed as a research university at all in 1973. The four that were "dropped" were all listed in 1976 as "Research Universities, II."

Another report based on similar criteria appeared in 1973, that of the Academy for Educational Development, as shown in Table II.(3) The report, entitled "The Campus Resources of Higher Education in the United States of America," listed 59 "leading research universities." As in the Carnegie study, there was no attempt to "rank" the institutions. The 59 were selected on the basis of Ph.D.'s granted and federal funds for research in the previous year.

Both the Carnegie reports and the report of the academy chose to combine two criteria: research support and Ph.D. production. This combination had a "levelling" effect--eliminating those institutions which for one reason or another are in good position to receive very large amounts of federal funding but which are not true graduate institutions in the production of a reasonable number of Ph.D.'s.

For purposes of this study we have used 1983 data. Table III shows the leading 100 universities in terms of total financial support for research for 1983. Table IV lists the institutions in Table III which produced 100 or more Ph.D.'s in 1983.

A third quantifiable criterion was introduced in a study conducted by the Subcommittee on Budget, Management, and Expenditures of the United States Committee on Governmental Operations (a committee of the Congress).(4) The report of this study, published in 1973, developed a ranking of all colleges and universities in the United States, based on the numbers of faculty members from each institution serving on federal "peer" committees and panels.

This resulted in a ranking of institutions based, at least to some extent, on the quality of faculty members as seen by their peers at other institutions and within the staffs of the

several federal agencies. This is the only study reported in the literature which might be considered an effort to focus on the quality of the total faculty of institutions--a criterion extremely difficult to measure. If it is used as such a measure, it must be recognized that an element of "reputation" must be present. It seems unlikely that all of the faculty members selected to serve on such panels and committees are representative of the best in their fields. Some must have been selected through the "old boy network," and some because of the reputation of the department or institution in which they teach.

However, since it is the only such study extant, it seems important to mention it here, and to express the hope that the Congress will see fit to update the study in the near future. It is after all, considered a mark of prestige to be invited to sit on peer committees of the National Science Foundation, the National Institutes of Health, and other such agencies.

If a "critical mass" of faculty members is to be considered a valid criterion for inclusion in lists of research universities, then the annual report of the National Science Foundation, a "headcount" of scientists and engineers on the faculties of the nation's universities, has value.(5) A research university needs a large faculty. Faculty members "have to have somebody to talk to," as we all know. More important, a large faculty provides an informal system of checks and balances in the research effort. Table V eliminates those institutions shown in Table IV which had fewer than 1,000 full-time science and engineering faculty members.

Last, and very significant, is a criterion which almost everyone can agree upon--the importance of the library or libraries in the evaluation of a research university. Fortunately, the Association of Research Libraries provides an annual ranking of its member institutions.(6) The Association ranks its member institutions in 15 variables, based on quantitative data, and then provides an "index" ranking--a kind of all-inclusive summary. Such data as number of volumes, serial subscriptions, funding, and size of library staff are included.

The most recent ARL Index is for 1983-84. Table VI lists all of the institutions (excluding Canadian universities) in the ARL Index for 1983-84.

TABLE I

The Carnegie Commission's "Research Universities I"(7)

1973 Public Universities	1976 Public Universities
University of Arizona	University of Arizona
University of California-Berkeley	University of California-Berkeley
University of California-Davis	University of California-Davis
University of California-L.A.	University of California-L.A.
University of California-San Diego	University of California-San Diego
University of Colorado	Colorado State University
University of Florida	University of Colorado
University of Georgia	University of Florida
University of Hawaii	University of Georgia
University of Illinois	University of Hawaii
Purdue University	University of Illinois
University of Iowa	Purdue University
University of Kentucky	University of Iowa
University of Maryland	University of Maryland
Michigan State University	Michigan State University
University of Minnesota	University of Minnesota
University of Missouri	University of Missouri
Rutgers University	North Carolina State University
North Carolina State University	University of North Carolina
University of North Carolina	Ohio State University
Ohio State University	Oregon State University
Pennsylvania State University	Pennsylvania State University
University of Pittsburgh	University of Pittsburgh
University of Tennessee	Texas A&M University
Texas A&M University	University of Texas
University of Utah	University of Utah
University of Washington	University of Washington
University of Wisconsin	University of Wisconsin

TABLE I (Continued)

1973 Private Universities	1976 Private Universities
Calif. Institute of Technology University of Southern California Stanford University Yale University University of Miami Northwestern University University of Chicago Johns Hopkins University Harvard University Massachusetts Inst. of Technology Washington University Princeton University Columbia University Cornell University New York University Rockefeller University University of Rochester Yeshiva University Duke University Case Western Reserve University University of Pennsylvania Vanderbilt University	Calif. Institute of Technology University of Southern California Stanford University Yale University University of Miami Northwestern University University of Chicago Johns Hopkins University Boston University Harvard University Massachusetts Inst. of Technology Washington University Princeton University Columbia University Cornell University New York University Rockefeller University University of Rochester Yeshiva University Duke University Case Western Reserve University University of Pennsylvania

TABLE II

The "Leading Research Universities--The Academy
For Educational Development, 1973"(8)

Boston University	University of California-San Diego
California Inst. of Technology	University of Chicago
Case Western Reserve University	University of Colorado
Colorado State University	University of Florida
Columbia University	University of Georgia
Cornell University	University of Hawaii at Manoa
Duke University	University of Illinois at Urbana
Harvard University	University of Iowa
Johns Hopkins University	University of Kansas
Massachusetts Inst. of Technology	University of Kentucky
Michigan State University	University of Maryland
New York University	University of Miami
North Carolina State Univ.-Raleigh	University of Michigan
Northwestern University	University of Minnesota
Ohio State University	University of Missouri
Oregon State University	University of North Carolina
Pennsylvania State University	University of Pennsylvania
Princeton University	University of Pittsburgh
Purdue University	University of Rochester
Rutgers University	University of Southern California
Stanford University	University of Tennessee
State University of New York	University of Texas
Temple University	University of Utah
Texas A&M University	University of Virginia
Tulane University of Louisiana	University of Washington
University of Arizona	University of Wisconsin
University of California-Berkeley	Vanderbilt University
University of California-Davis	Washington University
University of California-L.A.	Yale University
	Yeshiva University

The two Carnegie Commission on Higher Education reports were based on important quantitative measures of research university excellence: the number of doctoral degrees granted and the amount of federal support for scientific research. Quantitative data on doctoral degrees granted is considered to be an important measure of the stature of a university.

Why the Commission chose to limit its research support criteria to federal support is baffling. Much research support in today's research universities comes from the states--especially in the case of public universities--and from private sources such as endowments, foundation grants, and grants and contracts from business and industry, in all universities.

The National Science Foundation reports data on total financing of "research and development" expenditures at universities and colleges each year as well as federally financed R&D expenditures. The report of total R&D seems much more meaningful, especially considering that for a number of years medical schools and engineering schools have been heavily supported with federal funds, while federal support for basic science in certain other fields has barely kept pace with inflation. In some such cases, states, foundations, and private business and industry have stepped in and made up the size of the deficit.

Some states are more supportive of research in their public institutions than are others. These state dollars are just as important to the research effort as are the federal dollars. Private dollars, whether from philanthropic sources or from business and industry, are important to the program of the research university.

I believe that a list of leading research universities can be developed by taking the lists that rank universities on the basis of common standards mentioned earlier and subjecting them to a process of elimination. The following is the procedure that I have applied to arrive at a list of the leading research universities in the United States:

1. Begin with the 100 leading doctorate-granting universities in terms of total support for scientific research in 1983. See Table III.
2. Subtract from the list all those institutions which did not produce at least 100 Ph.D.'s in 1983. See Table IV.
3. Subtract from the remaining list all those institutions which employed fewer than 1,000 full-time scientists

and engineers as faculty members in 1983. See Table V.

4. Choose the leading research universities from the remaining institutions which rank highest in the ARL Index. See Table VI.

From this procedure emerge 57 universities which lead in the areas noted earlier as common standards that research universities must meet:

- Total financial support for scientific research.
- Production of Ph.D.'s in science and engineering.
- Critical mass of 1,000 or more scientists and engineers on the faculty.
- An outstanding research library.

Unfortunately, this eliminates certain prestigious smaller universities, most of which are always included in purely reputational listings, recognized for their superior programs and distinguished faculty members. In many cases these do not have the "critical mass" of science faculty members for which this classification procedure calls, nor do they graduate large numbers of Ph.D.'s in the sciences.

Subjecting available data (the four studies discussed) to the four-step elimination procedure delineated, I have developed a list of the 57 leading research universities in the United States. The use of four disparate criteria precludes an accurate ranking; therefore, I have listed them in alphabetical order in Table VII.

The list shown on Table VII, is admittedly biased in favor of institutions with strong research programs in the sciences, and in favor of the larger universities.

This list includes 41 public and 17 private universities, a disparity which may reflect the rapidly increasing costs of graduate education and research, and increased recognition and support by the public sector for graduate education and research.

Although the final list is a composite one, and therefore presented in alphabetical order rather than by rank, the "top 50" institutions in each of the four categories upon which that list was based are shown in rank order in Table II and Tables VIII-X. In Table X, the ARL library index scores are only a summary description of library size based on quantitative measures. The scores are in no way a qualitative measurement of the collections, services, or operations of the libraries.

TABLE III

R&D Expenditures (in thousands) at Doctorate-Granting
Institutions for Fiscal Year 1983(10)

Institutional Ranking	Total
1. Johns Hopkins University (Estimated)	303,115
2. Massachusetts Institute of Technology	200,349
3. University of Wisconsin-Madison	168,282
4. Stanford University	163,031
5. University of Minnesota	156,189
6. Cornell University	153,323
7. University of California-San Diego	147,008
8. University of Washington	133,523
9. University of Michigan	132,864
10. University of California-Berkeley	118,951
11. Harvard University	118,602
12. Columbia University-Main Division	113,847
13. University of Pennsylvania	113,499
14. University of California-Los Angeles	113,266
15. University of Texas-Austin	110,570
16. Texas A&M University	103,219
17. Yale University	100,269
18. University of Illinois-Urbana	99,135
19. University of California-Davis	98,118
20. Pennsylvania State University	89,767
21. University of California-San Francisco	89,247
22. University of Arizona	89,192
23. University of Southern California	84,395
24. Georgia Institute of Technology	82,924
25. Michigan State University	79,043
26. University of Colorado	75,798
27. Purdue University	75,510
28. University of Chicago	75,314
29. Ohio State University	74,146
30. University of Florida	73,467
31. University of Georgia	70,665
32. Washington University	69,357
33. New York University	68,554
34. Louisiana State University	68,383
35. University of Rochester	65,305

TABLE III (Continued)

Institutional Ranking	Total
36. Iowa State University	64,861
37. Oregon State University	62,723
38. North Carolina State University-Raleigh	59,909
39. University of Connecticut	58,902
40. Duke University	55,040
41. Baylor College of Medicine	54,986
42. University of Iowa	54,771
43. Yeshiva University	53,812
44. Rockefeller University	52,000
45. Northwestern University	51,075
46. University of North Carolina-Chapel Hill	50,892
47. SUNY at Buffalo	50,129
48. California Institute of Technology	49,824
49. Rutgers University	49,729
50. University of Miami	48,283
51. University of Pittsburgh	47,313
52. University of Utah	46,830
53. University of Hawaii-Manoa	45,401
54. University of Nebraska-Lincoln	44,597
55. University of Texas System Cancer Ctr.	44,509
56. University of Illinois-Chicago	44,497
57. Indiana University	44,331
58. University of Missouri-Columbia	44,231
59. Carnegie Mellon University	43,174
60. Case Western Reserve University	42,691
61. Oklahoma State University	42,503
62. Woods Hole Oceanographic Institute	42,070
63. New Mexico State University	41,579
64. Colorado State University	41,572
65. University of Oklahoma	40,987
66. University of Kentucky	40,829
67. Virginia Polytechnic Institute	40,420
68. University of Maryland-College Park	38,674
69. University of Virginia	37,620
70. University of Alaska-Fairbanks	37,325
71. University of California-Riverside	37,236
72. Princeton University	37,017
73. SUNY at Stony Brook	36,941

TABLE III (Continued)

Institutional Ranking	Total
74. Utah State University	36,711
75. University of Texas Health Science Center-Dallas	36,456
76. Mississippi State University	35,714
77. Kansas State University	35,310
78. Washington State University	33,583
79. University of New Mexico	33,356
80. University of California-Irvine	33,293
81. Boston University	32,421
82. University of Alabama-Birmingham	31,311
83. University of Massachusetts-Amherst	29,696
84. University of Cincinnati	29,008
85. CUNY Mt. Sinai School of Medicine	28,561
86. Vanderbilt University	26,322
87. Virginia Commonwealth University	26,235
88. Auburn University	26,176
89. University of Rhode Island	24,766
90. University of Texas Health Science Center-San Antonio	24,743
91. Temple University	24,632
92. Emory University	24,284
93. Wayne State University	23,990
94. Rensselaer Polytechnic Institute	23,084
95. University of California-Santa Barbara	22,884
96. Brown University	22,805
97. Florida State University	22,767
98. Tulane University	22,440
99. Arizona State University	22,294
100. University of Kansas	22,111

TABLE IV

The Leading Research Universities in Total R&D Expenditures
Which Had 100 or More Ph.D. Graduates in Academic Science in 1983
(Listed Alphabetically)

Arizona State University	University of Massachusetts, Amherst
University of Arizona	Michigan State University
Boston University	University of Michigan
Brown University	University of Minnesota
Case Western Reserve University	University of Missouri-Columbia
Colorado State University	University of Nebraska-Lincoln
Columbia University-Main Division	University of New Mexico
California Institute of Technology	New York University
University of Calif.-Berkeley	North Carolina State University-Raleigh
University of Calif.-Davis	University of North Carolina
University of Calif.-Los Angeles	Northwestern University
University of Calif.-Santa Barbara	Ohio State University
University of Calif.-San Diego	Oklahoma State University
University of Calif.-Riverside	University of Oklahoma
University of Southern California	Oregon State University
University of Chicago	Pennsylvania State University
University of Cincinnati	University of Pennsylvania
University of Colorado	University of Pittsburgh
University of Connecticut	Princeton University
Cornell University	Purdue University
Duke University	University of Rochester
Florida State University	Rutgers University
University of Florida	Stanford University
University of Georgia	SUNY at Buffalo
Harvard University	SUNY at Stony Brook
University of Hawaii-Manoa	Temple University
Johns Hopkins University	Texas A&M University
University of Illinois-Urbana	University of Texas-Austin
Indiana University	University of Utah
Iowa State University	Virginia Polytechnic Institute & SU
University of Iowa	University of Virginia
Kansas State University	University of Washington
University of Kansas	Washington University
University of Kentucky	Washington State University
Louisiana State University	Wayne State University
University of Maryl.-College Park	University of Wisconsin-Madison
Mass. Institute of Technology	Yale University

TABLE V

The Leading Research Universities in Total R&D Expenditures
Which Had 100 or More Ph.D. Graduates in Academic Science and
1,000 or More Full-Time Faculty Members in Academic Science and Engineering
(Listed Alphabetically)

University of Arizona	Michigan State University
Boston University	University of Michigan
University of Calif.-Berkeley	University of Minnesota
University of Calif.-Davis	University of Missouri-Columbia
University of Calif.-Los Angeles	New York University
University of Calif.-San Diego	N. C. State University-Raleigh
University of Southern California	University of N. C.-Chapel Hill
Case Western Reserve University	Northwestern University
University of Chicago	Ohio State University
University of Cincinnati	University of Oklahoma
Colorado State University	Oregon State University
Columbia University-Main Div.	Pennsylvania State University
University of Connecticut	University of Pennsylvania
Cornell University	University of Pittsburgh
Duke University	Purdue University
University of Florida	University of Rochester
University of Georgia	Rutgers University
Harvard University	Stanford University
University of Hawaii-Manoa	SUNY at Stony Brook
Johns Hopkins University	Temple University
University of Illinois-Urbana	Texas A&M University
Indiana University	University of Texas-Austin
Iowa State University	University of Utah
University of Iowa	Virginia Polytechnic Institute & SU
Kansas State University	University of Virginia
University of Kansas	University of Washington
University of Kentucky	Washington University
Louisiana State University	Wayne State University
University of Maryl.-College Park	University of Wisconsin-Madison
Mass. Institute of Technology	Yale University

TABLE VI

Institutions (Excluding Canadian Universities) in the
Association of Research Libraries Index, 1963-84(9)

University of Alabama	Miami University
Arizona State University	Michigan State University
University of Arizona	University of Michigan
Boston University	University of Minnesota
Brown University	University of Missouri
University of Calif.-Berkeley	University of Nebraska
University of Calif.-Davis	University of New Mexico
University of Calif.-Irvine	New York University
University of Calif.-Los Angeles	University of North Carolina
University of Calif.-Riverside	University of South Carolina
University of Calif.-Santa Barbara	North Carolina State University
University of Calif.-San Diego	Northwestern University
University of Southern California	Notre Dame University
Case Western Reserve University	Ohio State University
University of Chicago	Oklahoma State University
University of Cincinnati	University of Oklahoma
Colorado State University	University of Oregon
University of Colorado	Pennsylvania State University
Columbia University	University of Pennsylvania
University of Connecticut	University of Pittsburgh
Cornell University	Princeton University
Dartmouth University	Purdue University
University of Delaware	Rice University
Duke University	University of Rochester
Emory University	Rutgers University
Florida State University	Stanford University
University of Florida	SUNY at Albany
Georgia Institute of Technology	SUNY at Buffalo
University of Georgia	SUNY at Stony Brook
Georgetown University	Syracuse University
Harvard University	Temple University
University of Hawaii	University of Tennessee
University of Houston	Texas A&M University
Howard University	University of Texas
Johns Hopkins University	Tulane University
University of Illinois	University of Utah
Southern Illinois University	Vanderbilt University
Indiana University	Virginia Polytechnic Institute & SU
University of Iowa	University of Virginia
Iowa State University	Washington State University
University of Kansas	Washington University, St. Louis
Kent State University	University of Washington
University of Kentucky	Wayne State University
Louisiana State University	University of Wisconsin
University of Maryland	Yale University
Mass. Institute of Technology	Brigham Young University
University of Massachusetts	

An examination of those tables shows that of the nine institutions which appear in the "top 20" in all four categories, eight are public universities and one is private: Harvard University, which is first in two of the lists--rank in the ARL Index and numbers of scientists and engineers on the faculty. It ranks eighth in Ph.D.'s produced, and eleventh in total support for research.

The other eight include: Cornell, in the "top 10" in all categories; Wisconsin, in the "top 10" in three categories and eleventh in the fourth (ARL Index); Minnesota, in the "top 10" in three and thirteenth in the ARL Index; Michigan, in the "top 10" in three and thirteenth in the numbers of scientists and engineers on the faculty; UCLA and Illinois, in two of the "top 10" lists; and the University of Washington, in one "top 10" list; and Pennsylvania State University.

There are four universities which appear in the "top 20" in three of the four categories: Stanford University (in the "top 10" in all but the list of full-time science and engineering faculty); Columbia University (in the "top 10" in the ARL Index); Massachusetts Institute of Technology (second in total support); and the University of Texas (sixth in the ARL Index).

The private universities make their best showing in the category of total support: seven of the "top 20" are private, 13 public. In the ARL Index there are 14 public institutions and six private, in the "top 20." Sixteen public and four private universities are in the "top 20" in numbers of full-time scientists and engineers on the faculty; and 17 public universities and three private are among the "top 20" in Ph.D. degrees awarded.

There are many factors which contribute to the inclusion of certain universities in the list of 58 which lead the nation in the production of research and doctoral graduates. We have admitted to the bias of this study toward science, and toward the larger institutions, particularly at the graduate level. Other contributing factors have to do with the structure of the nation's leading universities.

For example, a few states have separate public medical schools, and therefore total support for science in the "main" state university is less than it would be if the medical school were a part of that main university.

Engineering is a field which attracts sizeable federal and industrial support. If an institution does not include an engineering school, its total support for research may be expected to be reduced accordingly.

In some cases, the fact that excellent, large libraries are located in nearby institutions or cities may have prevented the growth of the university's library.

Other distinguished universities have made conscious decisions to give emphasis to undergraduate excellence, or to such fields as the arts, the humanities, or theology, which may not attract large amounts of outside support for research.

TABLE VII

The Leading American Research Universities in Total Support for Research, Production of Ph.D. Degrees in Science and Engineering, Size of Faculty in Academic Science, and Size of Research Libraries, 1983.

University of Arizona	Michigan State University
Boston University	University of Michigan
University of Calif.-Berkeley	University of Minnesota
University of Calif.-Davis	University of Missouri
University of Calif.-Los Angeles	New York University
University of Calif.-San Diego	North Carolina State University
University of Southern California	University of North Carolina
Case Western Reserve University	Northwestern University
University of Chicago	Ohio State University
University of Cincinnati	University of Oklahoma
Colorado State University	Pennsylvania State University
Columbia University	University of Pennsylvania
University of Connecticut	University of Pittsburgh
Cornell University	Purdue University
Duke University	University of Rochester
University of Florida	Rutgers University
University of Georgia	Stanford University
Harvard University	SUNY at Stony Brook
University of Hawaii	Temple University
Johns Hopkins University	Texas A&M University
University of Illinois	University of Texas-Austin
Indiana University	University of Utah
Iowa State University	Virginia Polytechnic Institute & SU
University of Iowa	University of Virginia
University of Kansas	University of Washington
University of Kentucky	Washington University
Louisiana State University	Wayne State University
University of Maryland	University of Wisconsin
Mass. Institute of Technology	Yale University

TABLE VIII

The 50 Leading Research Universities
Granting Ph.D.'s in 1983(11)

University of Calif.-Berkeley	University of Florida
University of Wisconsin	University of N.C.-Chapel Hill
University of Michigan	Boston University
Ohio State University	University of Georgia
University of Illinois, Urbana	Florida State University
Michigan State University	University of Calif.-Davis
University of Minnesota	Texas A&M University
Harvard University	Northwestern University
University of Calif.-Los Angeles	Yale University
Stanford University	University of Arizona
University of Southern California	University of Iowa
Mass. Institute of Technology	Virginia Polytechnic Institute & State University
Cornell University	University of Virginia
University of Texas, Austin	University of Missouri-Columbia
Indiana University	Temple University
Pennsylvania State University	Iowa State University
University of Pittsburgh	University of Kansas
University of Washington	Wayne State University
Purdue University	University of Cincinnati
University of Pennsylvania	Johns Hopkins University
University of Maryland	Duke University
University of Chicago	University of Oklahoma
New York University	Oregon State University
Rutgers University	University of Rochester
Columbia University	University of Calif.-San Diego

Source: National Research Council. "Number of Institutions Granting Ph.D. Degrees and Number of Ph.D.'s From Each Institution by Field of Doctorate." 1983.

TABLE IX

The 50 Leading Research Universities in Numbers of Full-Time Scientists
and Engineers Employed in 1983(5)

Harvard University	University of Pennsylvania
Johns Hopkins University	University of Washington
University of Wisconsin	University of Calif.-Davis
University of Minnesota	Rutgers University
Louisiana State University	Duke University
Cornell University	University of Calif.-Berkeley
Ohio State University	University of Arizona
University of Florida	University of Calif.-San Francisco
Texas A&M University	University of Colorado
Mass. Institute of Technology	New York University
University of Calif.-Los Angeles	Case Western Reserve University
University of Illinois	Iowa State University
University of Michigan	University of Calif.-San Diego
Pennsylvania State University	University of Connecticut
Purdue University	University of Southern California
Columbia University	University of Kansas
University of Kentucky	University of Maryland
University of Washington	Northwestern University
University of Utah	CUNY, Mt. Sinai
Yale University	University of Missouri
Indiana University	University of North Carolina
North Carolina State University	University of Rochester
Michigan State University	University of Miami
University of Iowa	University of Georgia
University of Texas	

Source: National Science Foundation. Academic Science/Engineering: Scientists and Engineers. (January, 1984), Table B-51.

TABLE X

ARL Library Index, 1983-84, Excluding Canadian Universities, By Rank Order.

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|--------------------------------------|--------------------------------------|
| 1. Harvard University | 48. The University of Kentucky |
| 2. University of Calif.-L.A. | 49. Boston University |
| 3. University of Calif.-Berkeley | 50. The University of Cincinnati |
| 4. Yale University | 51. Georgetown University |
| 5. Stanford University | 52. Wayne State University |
| 6. The University of Texas | 53. Virginia Polytechnic Institute |
| 7. The University of Illinois | 54. Washington University, St. Louis |
| 8. Columbia University | 55. The University of Missouri |
| 9. The University of Michigan | 56. The University of Connecticut |
| 10. Cornell University | 57. The University of Rochester |
| 11. The University of Wisconsin | 58. Emory University |
| 12. The University of Washington | 59. Miami University |
| 13. The University of Minnesota | 60. University of Southern Illinois |
| 14. Ohio State University | 61. Washington State University |
| 15. Princeton University | 62. Purdue University |
| 16. The University of North Carolina | 63. The University of South Carolina |
| 17. The University of Indiana | 64. Iowa State University |
| 18. Pennsylvania State University | 65. Brigham Young University |
| 19. The University of Arizona | 66. Brown University |
| 20. The University of Chicago | 67. SUNY at Stony Brook |
| 21. University of Calif.-Davis | 68. University of Calif.-Irvine |
| 22. The University of Pennsylvania | 69. Vanderbilt University |
| 23. The University of Virginia | 70. The University of Utah |
| 24. Rutgers University | 71. The University of Colorado |
| 25. Howard University | 72. Temple University |
| 26. The University of New York | 73. The University of Nebraska |
| 27. The University of Georgia | 74. Tulane University |
| 28. Arizona State University | 75. North Carolina State University |
| 29. SUNY at Buffalo | 76. The University of Oklahoma |
| 30. Northwestern University | 77. Georgia Institute of Technology |
| 31. University of Southern Calif. | 78. SUNY at Albany |
| 32. Michigan State University | 79. The University of New Mexico |
| 33. Duke University | 80. The University of Tennessee |
| 34. The University of Kansas | 81. The University of Massachusetts |
| 35. The University of Iowa | 82. The University of Delaware |
| 36. University of Calif.-Santa Barb. | 83. The University of Oregon |
| 37. The University of Florida | 84. Florida State University |
| 38. The University of Pittsburgh | 85. Dartmouth University |
| 39. University of Calif.-San Diego | 86. University of Calif.-Riverside |
| 40. The University of Houston | 87. The University of Alabama |
| 41. Texas A&M University | 88. Colorado State University |
| 42. Johns Hopkins University | 89. The University of Notre Dame |
| 43. Louisiana State University | 90. Kent State University |
| 44. The University of Maryland | 91. Rice University |
| 45. The University of Hawaii | 92. Oklahoma State University |
| 46. Syracuse University | 93. Case Western Reserve University |
| 47. Mass. Institute of Technology | |
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Footnotes

(1) The Carnegie Commission on Higher Education. A Classification of Institutions of Higher Education. A Technical Report. McGraw-Hill, 1973.

(2) Ibid., 1976.

(3) Management Division, Academy for Educational Development, Inc., The Campus Resources of Higher Education in the United States of America. (1973, November).

(4) Federal Advisory Committees, First Annual Report of the President to the Congress, Washington: U.S. Government Printing Office, (1974, January 7), Part 5.

(5) National Science Foundation, Academic Science/Engineering: Scientists and Engineers, (1984, January), Table B-51.

(6) Stubbs, Kenneth. The ARL Library Index and Quantitative Relationships in the ARL. Washington: ARL, 1980.

(7) Carnegie Commission, op. cit.

(8) Academy for Educational Development, op. cit.

(9) Stubbs, op. cit.

(10) National Science Foundation, Academic Science/Engineering: R&D Funds, Fiscal Year 1983, (1984, January), Table E-29.

(11) National Research Council. "Number of Institutions Granting Ph.D. Degrees and Number of Ph.D.'s From Each Institution by Field of Doctorate." 1983.

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